# Discussion of 'Pairwise Trading in the Money Market during the European Sovereign Debt Crisis' by Edoardo Rainone

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### Paper overview

- ► Topic: Analysis of conditions for banks in the money market during the sovereign debt crisis.
- ▶ Background: Aggregate evidence for substantial increase in rate dispersion since the start of the crisis.
  - $\Rightarrow$  Undesirable from regulatory point of view, points to non-smooth monetary policy transmission.
  - $\Rightarrow$  May be due to increased monitoring, as well as relationship lending.

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- ▶ Idea: Use granular (TARGET2) data on unsecured interbank lending to study "who trades with whom, how much, and at what price".
- Methodology: Econometric model for dyadic data, controlling for selection bias.

# Potential selection bias (1/2)

Outcome (rate) equation:

$$p_i = X_i'\beta + \epsilon_i \tag{1}$$

Aim: Estimate  $\beta$ . Problem: *i* only observed if lender and borrower agree.

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In this case.

$$E[p_i|X_i, i \text{ is observed}] = X_i'\beta + \underbrace{E[\epsilon_i|X_i, i \text{ is observed}]}_{\neq 0}$$
 (2)

and  $\beta$  cannot be estimated consistently by OLS.

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 (3)

$$Pr(s_{i,b}^* \ge 0) = \Phi(Z_{i,b}'\gamma_b + v_{i,b})$$
 (4)

where  $s_{i,j}^*$ ,  $j \in I, b$  is the expected payoff from trade i.

 $\Rightarrow$  Trade *i* is only observed if  $I(s_{i,l}^* \ge 0) \cdot I(s_{i,b}^* \ge 0) = 1$ .

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- $\Rightarrow$  Trade i is only observed if  $I(s_{i,l}^* \geq 0) \cdot I(s_{i,b}^* \geq 0) = 1$ .
- Including estimates of so-called inverse Mills ratios  $\lambda_{i,j} = \frac{-\phi\left(\frac{Z_i^i \gamma_j}{\sigma_{v,j}}\right)}{\Phi\left(\frac{Z_j^i \gamma_j}{\sigma_{v,j}}\right)}$ ,

 $j \in I, b$ , as regressors in (1) gives unbiased estimates of  $\beta$ .

### **Empirical findings**

Who trades with whom?

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- ▶ Borrower balance sheets become increasingly important after the start of the crisis; effect diminishes after LTROs.

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Evidence for liquidity hoarding in some countries during the sovereign debt crisis.

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### At what prices?

- ▶ Borrowers' nationalities matter a lot.
- Big banks charge higher rates as lenders and pay lower rates as borrowers.

### **Comment 1: Specification of outcome equations**

For an observed trade at time t, the exchanged rate and quantity are modeled as

$$q_{lb,t} = g(B_{l,t}, C_{l,t}, B_{b,t}, C_{b,t}, k_{b,t-1}, k_{l,t-1}, g_{lb,t-1})$$
 (5)

$$p_{lb,t} = f(B_{l,t}, C_{l,t}, B_{b,t}, C_{b,t}, q_{lb,t})$$
(6)

where  $B_{l,t}$ ,  $B_{b,t}$ ,  $C_{l,t}$ ,  $C_{b,t}$  denote lender and borrower characteristics,  $k_{b,t-1}$ ,  $k_{l,t-1}$  capture past lending and borrowing activities, and  $g_{lb,t-1}$  equals one if l and b have traded in t-1.

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- ▶ Parameterization (equation (12) in the paper) in terms of parameters of the selection equation. Structural or reduced form model? Identification?
- Quantity exogenous to rate, but not vice versa?

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- ➤ Time-series properties/persistence of estimated parameters? Periods of parameter stability?
- Possibly: Time-varying parameter model, for example

$$p_{lb,t} = X_{lb,t}\beta_t + \epsilon_{lb,t}, \quad \epsilon_{lb,t} \sim N(0, \sigma_{\epsilon}^2)$$
 (7)

$$\beta_{t+1} = A\beta_t + \eta_t, \quad \eta_t \sim N(0, \Sigma_{\eta})$$
 (8)

where  $X_{lb,t}=(1,x_{lb,t},q_{lb,t},\lambda_{l,t},\lambda_{b,t})'$   $\beta_t=(\beta_{0,t},\beta_{1,t},\alpha_t)'$ , A is a matrix of unknown coefficients,  $\sigma_\epsilon^2$  is an unknown variance, and  $\Sigma_\eta$  is an unknown covariance matrix.

 $\Rightarrow$  extract  $\beta_t$  via Kalman filter and estimate unknown parameters using maximum likelihood.

### Other questions/comments

- ▶ Tables 2 5: Omit results from simple linear regression estimation?
- Quantity equation Lender country effects (Figure 13): Everybody lends less than German banks?
- ▶ Include central bank as lender of last resort into the model?
- ▶ Policy implications? Possible to extract a measure of systemic risk/monetary policy transmission "malfunction"?

### **Conclusion**

- Very interesting paper!
- In-depth empirical study of interbank trade data, explicitly controlling for selection bias.
- Zooming into the interbank market and using a model for granular trade data helps to explain increased dispersion of rates during the sovereign debt crisis.
- Relationships between structural and reduced form model parameters can be clarified.
- Methodology could be extended to exploit the panel structure of the data.

